

***Snap-on***<sup>®</sup>

MAKES A

**SOCKET**

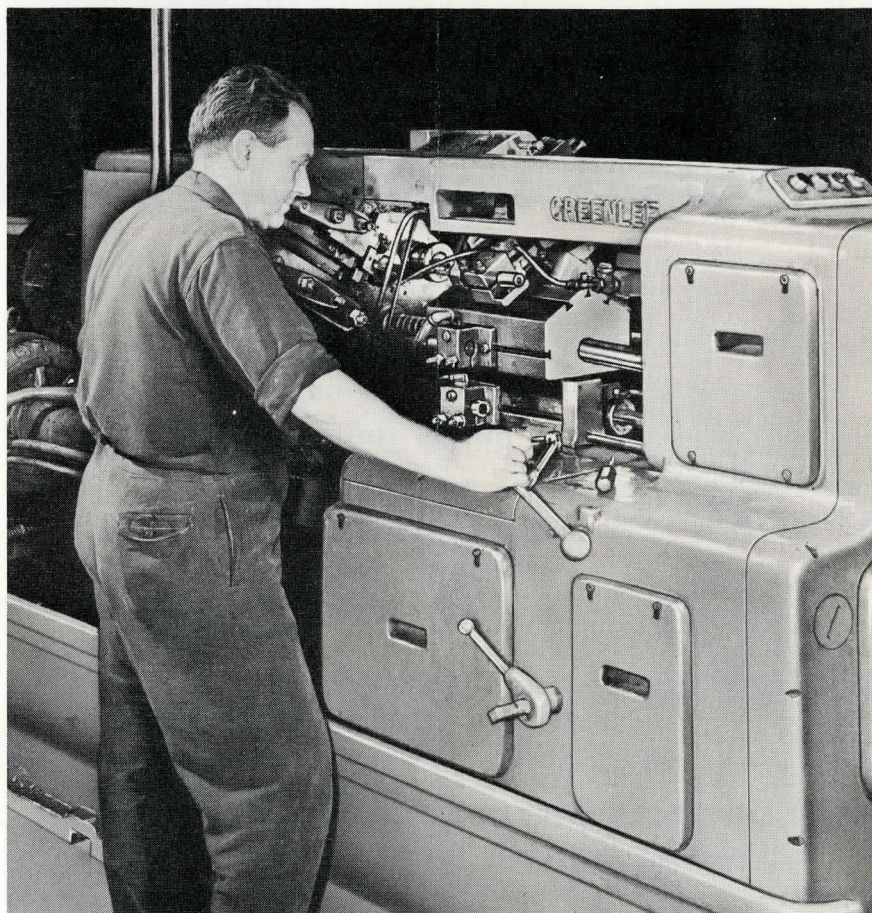
**SNAP-ON TOOLS CORPORATION**  
Kenosha, Wisconsin

SEE HOW  
IT'S DONE

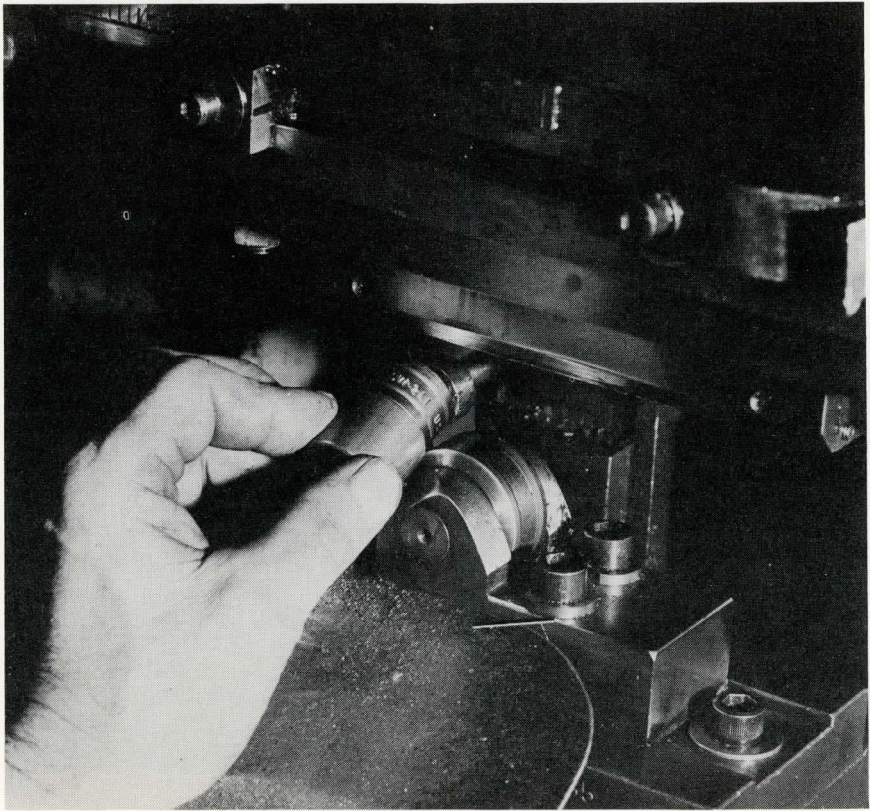


## MANUFACTURING A SOCKET

**A.** The socket which we show in various phases of operation on the panel board is an SW-241. It is made from #8630, round, bar steel which is 1-3/64" in diameter. These steel bars are fed into an automatic machine which performs several different operations all at the same time. The socket on our board has been through two automatic machines. In the first one it has been spot drilled, the hex end chamfered, the hex end drilled, the handle hole drilled, the outside of the socket formed, and the outside of the socket shaved and burnished and then the socket was cut off from the rest of the bar. In an automatic machine the drill remains stationary while the round bar of steel is turning so that in some cases, while the socket is being drilled on the inside, the outside of the socket can be formed at the same time. The reason the hex end of the socket is chamfered or counter-sunk is to facilitate the broaching operation later on, and also so that the socket will easily slide over a nut in actual use later on. The outside of the socket is shaved and burnished on that portion which is to be stamped, and the purpose of this operation is to leave a smooth finish.



An Automatic Screw Machine



Sockets Being Roller Stamped

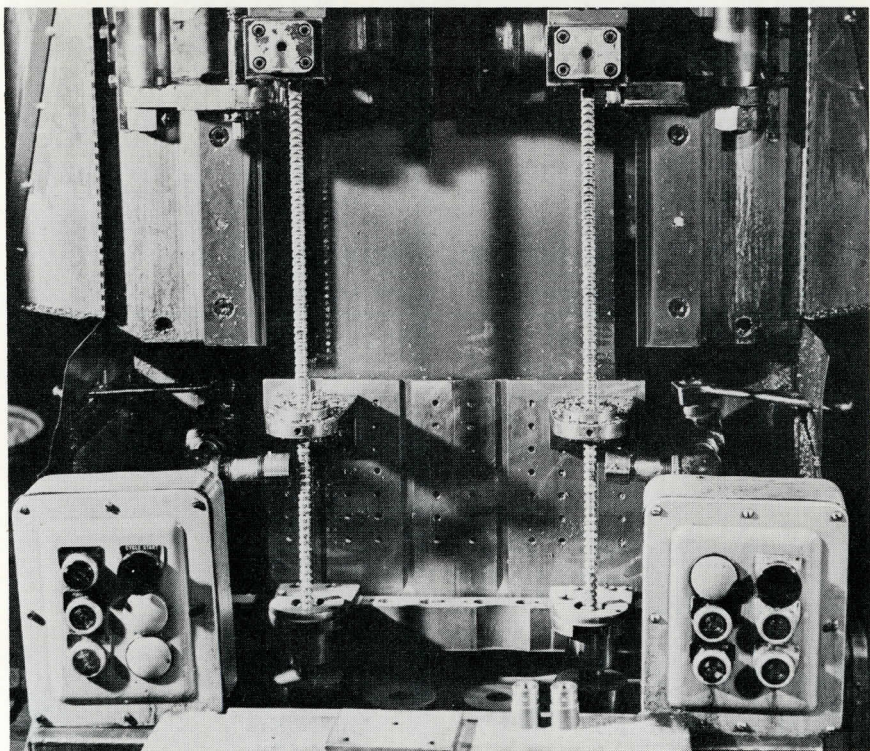
Three more operations were performed on a second automatic machine. First the handle hole was reamed, which means that it was made to the correct size for accurate broaching with the minimum amount of steel removal. The handle hole was then recessed and this recess or removal of stock from the inside of the handle hole was performed so that a small indentation remained after the broaching operation. This small indentation helps to hold the socket on a ratchet or some other handle. The ball in the handle fits into this small indentation. The socket was then faced or made smooth on the handle end to remove all machine marks. During the machining operations of the automatic screw machines, oil is sprayed over all working and cutting parts to remove the heat of friction. On the sample socket shown on the board a 6 spindle automatic machine was used as is seen in the photograph. The automatic blank on the panel board shows that all 9 of these automatic operations have been performed.

**B.** A roller stamp now imprints the trademark, size, stock number, the letters USA, and the year symbol on the socket in one fast operation. Since the socket on the board is an SW-241 you will note that the stamping consists of the words "Snap-on  $\frac{3}{4}$  SW-241 USA 9". Year symbols change in design every 10 years so we know exactly when the socket was manufactured. After the stamping operation, the handle hole is broached. This is done by a draw broach or cutting tool which has many teeth progressively larger so that each one takes a small cut. Cutting oil is sprayed on the socket

and the broach to remove heat and to facilitate the broaching operation. The broaching or reaming leaves the handle hole to the exact size designated in the specifications.

C. The socket is now broached on the other end which is the socket end, and here a double hex is broached while the socket is hot. The socket is first heated cherry red and then is placed in a holding fixture while the broaching bar is pressed into the opening. The broach is shaped to curl the chips in the bottom of the inside of the socket as can be seen by an examination of the sample on the panel board. A visual inspection is made after the broaching operation to be sure that each socket has been properly manufactured up to that point.

D. The socket is now heat-treated and drawn. (See front cover.) It is heated in a furnace for about one hour at a temperature of approximately 1500° F. and is then hardened by being dropped into quenching oil at approximately 100° F. It is then put in a draw furnace at 800° and slowly cooled to obtain the exact hardness specified for an SW-241. Heat treating of a socket is very necessary in order that the inside edges will not wear causing the socket to slip, and, at the same time, they must not be too hard so that the socket will break. Although heat-treating is something that cannot be seen in the finished socket, it is, nevertheless, a very important part in the manufacture of the socket. It is the carefully controlled heat-treating that gives Snap-on sockets a long and useful life. After heat-treating is completed, the socket is then sand-blasted in order to remove scale and surface discoloring. This is done by placing them in a

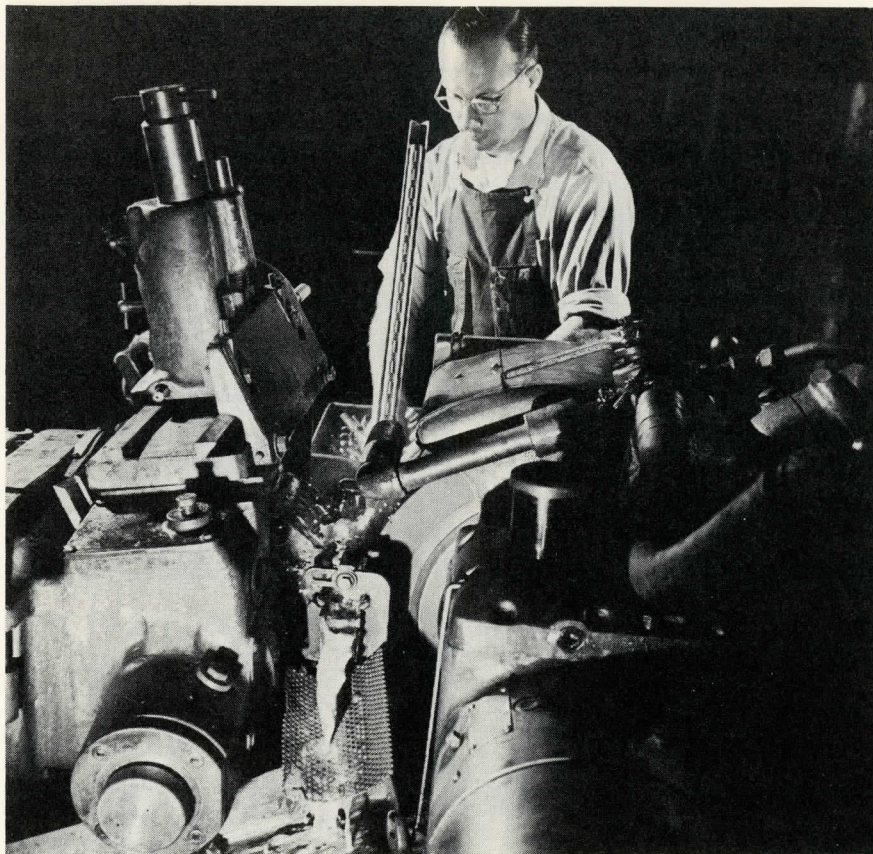


Handle Hole Being Broached with a Draw Broach

sand-blasting machine which has a wheel which moves at high speed, hurling sand particles at the sockets while they are tumbling.

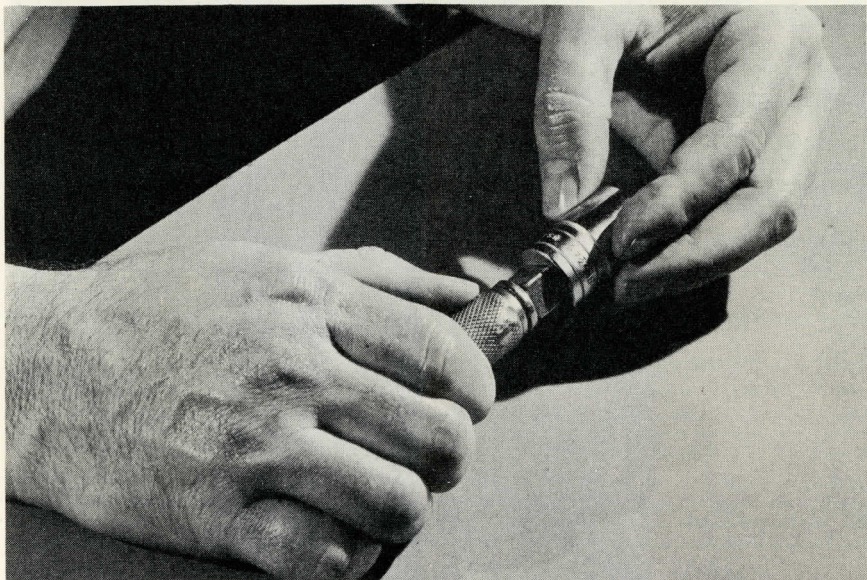
**E.** The socket is then put through a centerless grinder three times. In this grinding machine the socket slides between two grinding wheels which can be set to very close tolerances. In this way, the exterior of the socket can be polished to a very high finish. The first time through the machine a combination 46 grit and 60 grit stone is used at a rather high speed, and the second time, a combination 46 and 60 grit stone is used at a slower speed. During the last time through this grinding machine, a 240 grit stone is used which leaves a mirror-like finish. Since even the smallest scratches can be seen through the plating of a socket, it is necessary that the finish be perfect before the socket is plated.

**F.** The socket now goes to the plating room where it is placed on a conveyor which dips it in a cleaning solution to remove grease and then a muriatic acid dip to remove surface impurities. Following this it is immersed in the nickel plating tanks where it is electrochemically plated and then is rinsed once more. It is then placed in the chrome plating tanks after which it is rinsed again and dried in saw dust. The



Sockets Going Thru the Centerless Grinder

socket then goes to the Inspection Department where it is visually inspected and both the handle and socket openings checked with go-no go gages. Both the hex end and handle hole end are then retouched with aluminum paint to cover any marks that may have been left by the racks during the plating process and to prevent rust in storage. The manufacturing process has now been completed and the sockets are packed in cartons and are ready for shipment to all parts of the United States.



Inspection with a Go-No-Go Gauge